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# TEST REPORT

**Report Number:** 102083831LEX-002
**Project Number:** G102083831

**Report Issue Date:** 5/29/2015

**Product Name:** PocketECG III, type PECGT-IIIV

**FCC Standards:** Title 47 CFR Part 22 and 24, RSS-132 Issue 3, RSS-133 Issue 6

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510

Client:
Medicalgorithmics SA
Al. Jerozolimskie 81
02-001 Warszawa, Poland

Report prepared by

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Report reviewed by

Jason Centers, Staff Engineer

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## 1 Introduction and Conclusion

The tests indicated in Section 2 were performed on the product constructed as described in Section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington laboratory is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under Registration Number 485103.

## 2 Test Summary

| Page | Test full name | FCC Reference | Industry Canada | Result |
|---|---|---|---|---|
| 6 | Conducted Output Power | §2.1046<br>§24.232(d) | RSS-132 (4.4),<br>RSS-133 (4.1),<br>RSS-133 (6.4) | Pass |
| 13 | Occupied Bandwidth | §2.1049,<br>§22.917(b)(d), and<br>§24.238(a) | RSS-GEN (4.6.1),<br>RSS-133 (2.3) | Pass |
| 20 | Conducted Spurious Emissions | §2.1049, §2.1051,<br>§22.917(a)(b), and<br>§ 24.238(a)(b) | RSS-132 (4.5),<br>RSS-133 (6.5.1) | Pass |
| 27 | Radiated Output Power | § 22.913(a) and<br>§ 24.232(c) | RSS-132 (4.4),<br>RSS-133 (6.4) | Pass |
| 28 | Radiated Spurious Emissions (Transmitter) | §2.1053,<br>§22.917(a)(b), and<br>§24.238(a)(b) | RSS-132 (4.5),<br>RSS-133 (6.5) | Pass |
| 32 | Frequency Stability | §2.1055, §22.355,<br>and §24.235 | RSS-132 (4.3),<br>RSS-133 (6.3) | Pass |

## 3 Description of Equipment Under Test

| Equipment Under Test | |
|---|---|
| **Manufacturer** | Medicalgorithmics SA |
| **Model Number** | PocketECG III, type PECGT-IIIV |
| **Serial Number** | Test Sample 1 |
| **Receive Date** | 4/21/2015 |
| **Test Start Date** | 5/12/2015 |
| **Test End Date** | 5/18/2015 |
| **Device Received Condition** | Good |
| **Test Sample Type** | Production |
| **Frequency Band** | 824MHz - 849MHz (CDMA Cell Band)<br>1850MHz – 1910MHz (CDMA PCS Band) |
| **Modulation Type** | CDMA |
| **Transmission Control** | Base Station Simulator |
| **Maximum Output Power (Conducted)** | 24.01dBm (Cell Band)<br>23.61dBm (PCS Band) |
| **Test Channels** | 1013, 384, and 777 (CDMA Cell Band)<br>25, 600, and 1075 (CDMA PCS Band) |
| **Antenna Type** | Internal |
| **Operating Voltage** | Battery Powered by 3.7VDC |

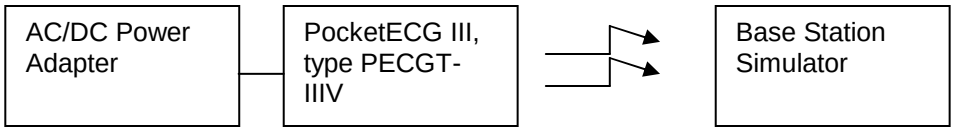
| Description of Equipment Under Test |
|---|
| The PocketECG III, type PECGT-IIIV is a hand held ECG meter with wireless capabilities. |

**Operating modes of the EUT:**

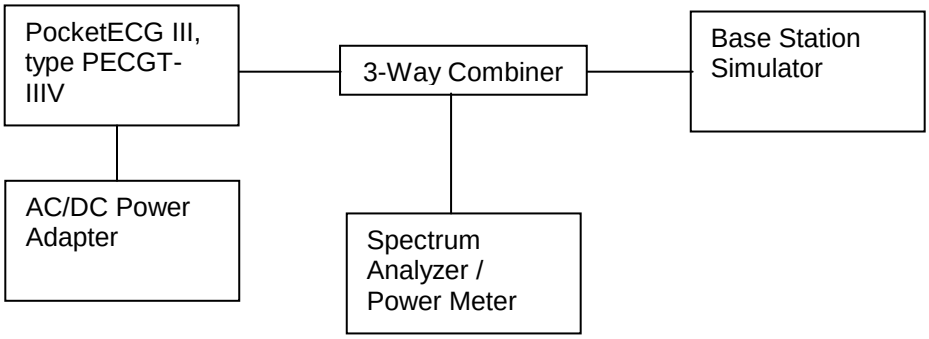
| No. | Descriptions of EUT Exercising |
|---|---|
| 1 | Transmitting a CDMA signal |
| 2 | Receive / idle mode |

### 3.1 System setup including cable interconnection details, support equipment and simplified block diagram

### 3.2 EUT Block Diagram:




Block Diagram for Radiated Tests




Block Diagram for Conducted Tests at the Antenna Port

### 3.3 Cables:

| Cables | | | | | |
|---|---|---|---|---|---|
| Description | Length | Shielding | Ferrites | Connection | |
| | | | | From | To |
| Sensor Cables | 3ft | None | None | Test Sample | Un-Terminated |

# 4 Conducted Output Power

## 4.1 Test Limits

**§ 2.1046**

For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8).

**§ 24.232 (d)**

Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

## 4.2 Test Procedure

The transmitter output was connected to a coaxial cable, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The EUT was placed into a call and the burst average power was measured with a power meter dBm. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. Tests were performed at three frequencies (low, middle, and high channels) and on the highest power levels, which can be setup on the transmitters.

The peak-to-average ratio (PAR) was measured using a spectrum analyzer with a RBW wider than the EBW of the measured signal. The delta between the peak and average trace was recorded.

## 4.3 Test Equipment Used:

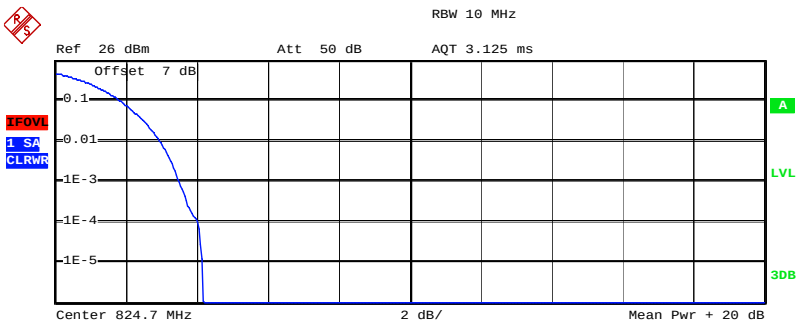
| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Base Station Simulator | 3956 | Rohde & Schwarz | CMU200 | 9/18/2014 | 9/18/2015 |
| Spectrum Analyzer | 3099 | Rohde & Schwarz | FSP7 | 9/15/2014 | 9/15/2015 |
| Power Divider | E18106 | Weinschell Engineering | 1506A | Time of Use | Time of Use |

## 4.4 Results:

The table below shows the conducted output power delivered to the radiating antenna. Plots are also provided showing that the peak to average ratio in the Cell Band is below the 13dB limit.

**Conducted Output Power**

| Band | Channel | Frequency (MHz) | RC1/SO55 | RC3/SO55 | RC3/SO32 (+F-SCH) | RC3/SO32 (+SCH) | 1xEvDO Rev. 0 (RTAP) | 1xEvDO Rev. A (RETAP) |
|---|---|---|---|---|---|---|---|---|
| | 1013 | 824.7 | 23.69 | 23.59 | 23.57 | 23.35 | 23.03 | 23.1 |
| | 384 | 836.52 | 24.01 | 23.96 | 24 | 23.75 | 23.47 | 23.6 |
| Cellular | 777 | 848.31 | 23.51 | 23.49 | 23.42 | 23.14 | 23.21 | 23.15 |
| | 25 | 1851.25 | 23.61 | 23.42 | 23.53 | 23 | 22.85 | 23 |
| | 600 | 1880 | 23.6 | 23.42 | 23.48 | 23.15 | 23.2 | 23.04 |
| PCS | 1175 | 1908.75 | 23.47 | 23.09 | 23.23 | 23.17 | 22.64 | 22.53 |

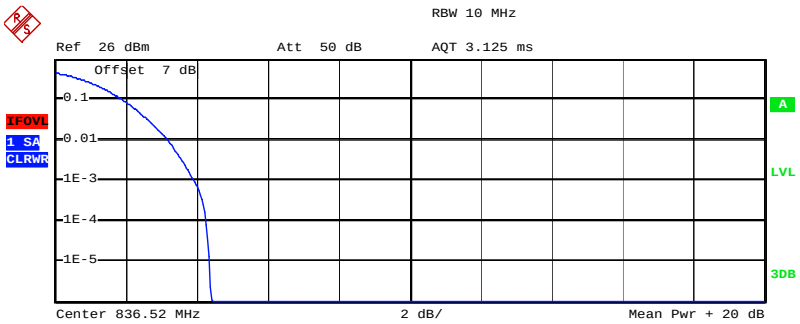



Complementary Cumulative Distribution Function (100000 samples)

| | Trace 1 |
|---|---|
| Mean | 25.76 dBm |
| Peak | 29.94 dBm |
| Crest | 4.18 dB |
| 10 % | 1.88 dB |
| 1 % | 2.96 dB |
| .1 % | 3.52 dB |
| .01 % | 4.04 dB |

Date: 20.MAY.2015 14:40:45

**Peak to Average Ratio Channel 1013**




Complementary Cumulative Distribution Function (100000 samples)

| | Trace 1 |
|---|---|
| Mean | 26.03 dBm |
| Peak | 30.43 dBm |
| Crest | 4.40 dB |
| 10 % | 1.96 dB |
| 1 % | 3.20 dB |
| .1 % | 3.96 dB |
| .01 % | 4.28 dB |

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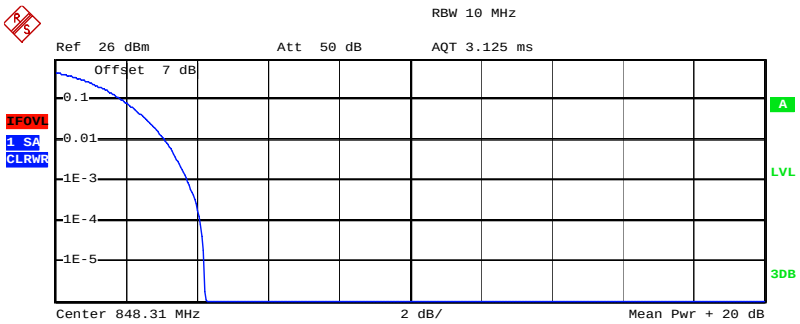
**Peak to Average Ratio Channel 384**

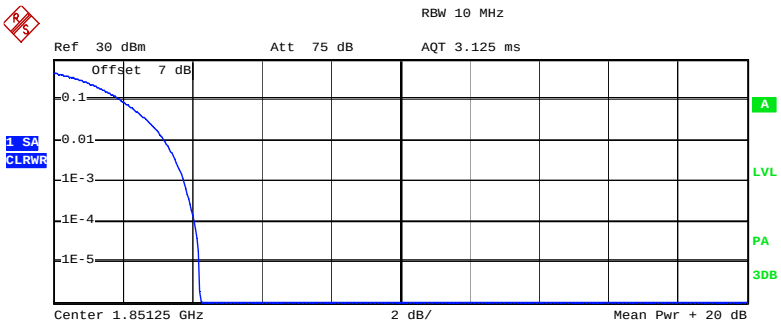



**Complementary Cumulative Distribution Function (100000 samples)**

| | Trace 1 |
|---|---|
| Mean | 25.63 dBm |
| Peak | 29.87 dBm |
| Crest | 4.24 dB |
| 10 % | 1.92 dB |
| 1 % | 3.12 dB |
| .1 % | 3.76 dB |
| .01 % | 4.12 dB |

Date: 20.MAY.2015 14:41:35

**Peak to Average Ratio Channel 777**

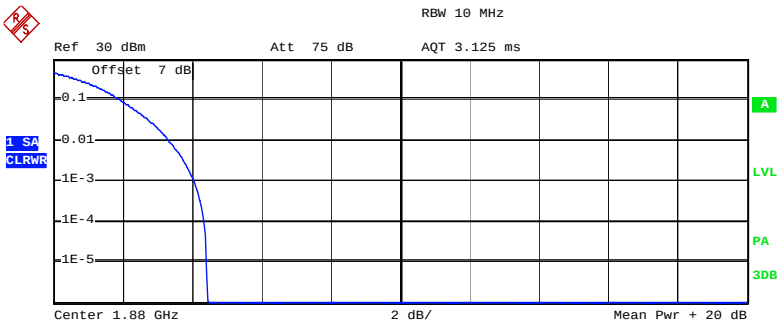



Complementary Cumulative Distribution Function (100000 samples)

| | Trace 1 |
|---|---|
| Mean | 25.75 dBm |
| Peak | 29.99 dBm |
| Crest | 4.24 dB |
| 10 % | 2.00 dB |
| 1 % | 3.20 dB |
| .1 % | 3.80 dB |
| .01 % | 4.08 dB |

Date: 4.JUN.2015 15:19:35

**Peak to Average Ratio Channel 25**

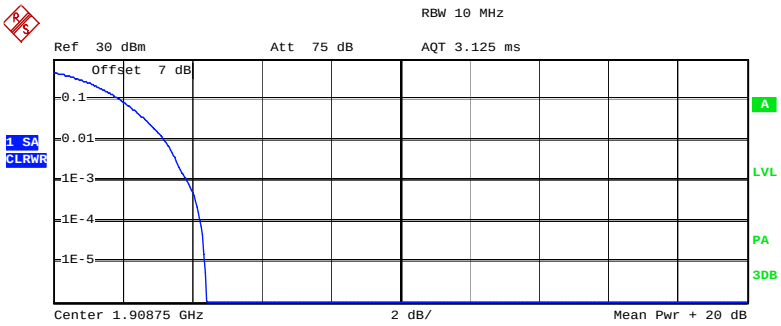



Complementary Cumulative Distribution Function (100000 samples)

| | Trace 1 |
|---|---|
| Mean | 25.20 dBm |
| Peak | 29.64 dBm |
| Crest | 4.44 dB |
| 10 % | 2.00 dB |
| 1 % | 3.36 dB |
| .1 % | 4.08 dB |
| .01 % | 4.36 dB |

Date: 4.JUN.2015 15:20:29

**Peak to Average Ratio Channel 600**




Complementary Cumulative Distribution Function (100000 samples)

| | Trace 1 |
|---|---|
| Mean | 25.56 dBm |
| Peak | 29.99 dBm |
| Crest | 4.43 dB |
| 10 % | 1.96 dB |
| 1 % | 3.24 dB |
| .1 % | 3.88 dB |
| .01 % | 4.24 dB |

Date: 4.JUN.2015 15:21:07

**Peak to Average Ratio Channel 1175**

# 5 Occupied Bandwidth

## 5.1 Test Limits

**§2.1049:**

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

## 5.2 Test Procedure

The EUT was connected to a spectrum analyzer using a coaxial cable and power divider. The EUT was placed into a call using base station simulator. The base station simulator was set to force the EUT to its maximum power setting. The occupied bandwidth function of the analyzer was used to automatically generate the occupied bandwidth plots. The ndB down function of the analyzer was used to automatically measure the 26dB emission bandwidth. A peak detector was used for this measurement.

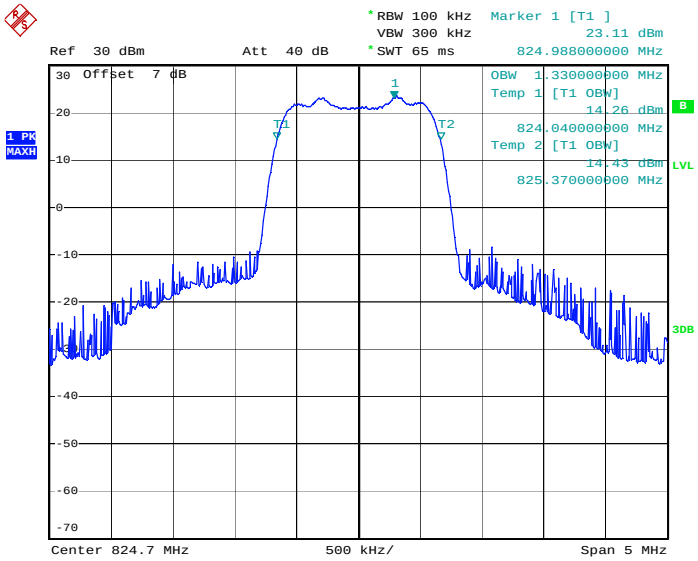
## 5.3 Test Equipment Used:

| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Base Station Simulator | 3956 | Rohde & Schwarz | CMU200 | 9/18/2014 | 9/18/2015 |
| Spectrum Analyzer | 3099 | Rohde & Schwarz | FSP7 | 9/15/2014 | 9/15/2015 |
| Power Divider | E18106 | Weinschell Engineering | 1506A | Time of Use | Time of Use |

## 5.4 Results:

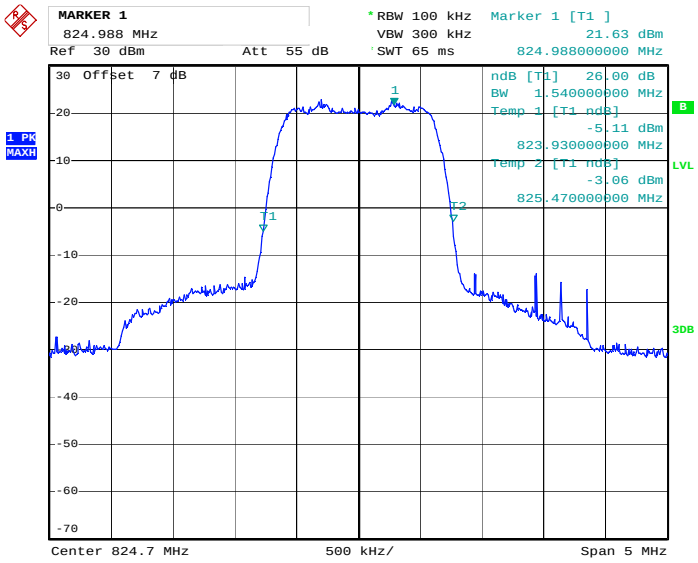
The bandwidth measurements are shown in the table below and the plots that follow.

| TX Band | Channel | Frequency | 99% Occupied Bandwidth | 26dB Emission Bandwidth |
|---|---|---|---|---|
| Cell | 1013 | 824.7MHz | 1.33MHz | 1.54MHz |
| | 384 | 836.52MHz | 1.33MHz | 1.53MHz |
| | 777 | 848.31MHz | 1.32MHz | 1.53MHz |
| PCS | 25 | 1851.25MHz | 1.32MHz | 1.56MHz |
| | 600 | 1880.00MHz | 1.32MHz | 1.54MHz |
| | 1175 | 1908.75MHz | 1.33MHz | 1.54MHz |



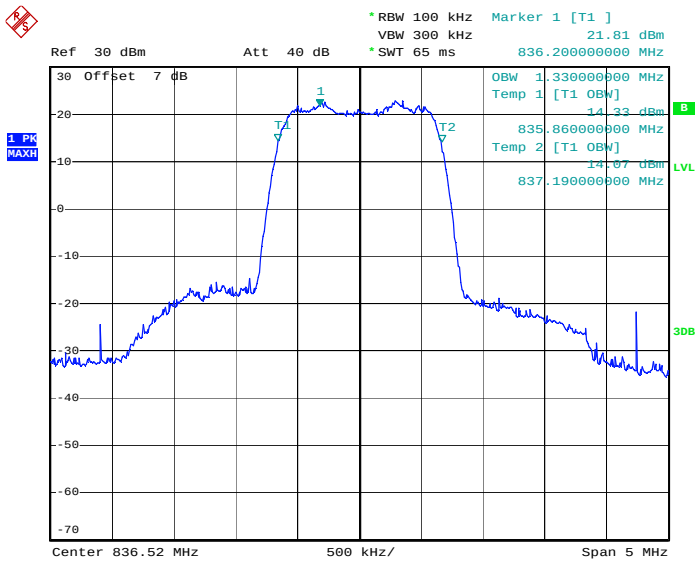

Date: 13.MAY.2015 14:22:03

**Cell Channel 1013, 99% Bandwidth**



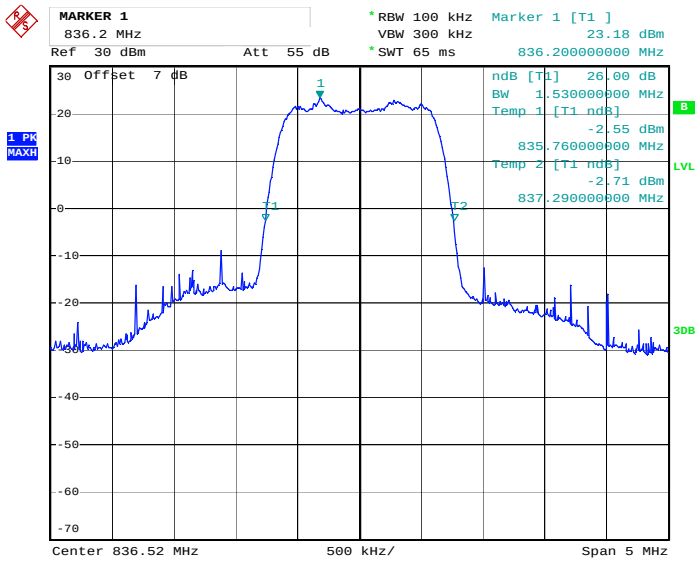

Date: 13.MAY.2015 14:24:06

**Cell Channel 1013, 26dB Bandwidth**



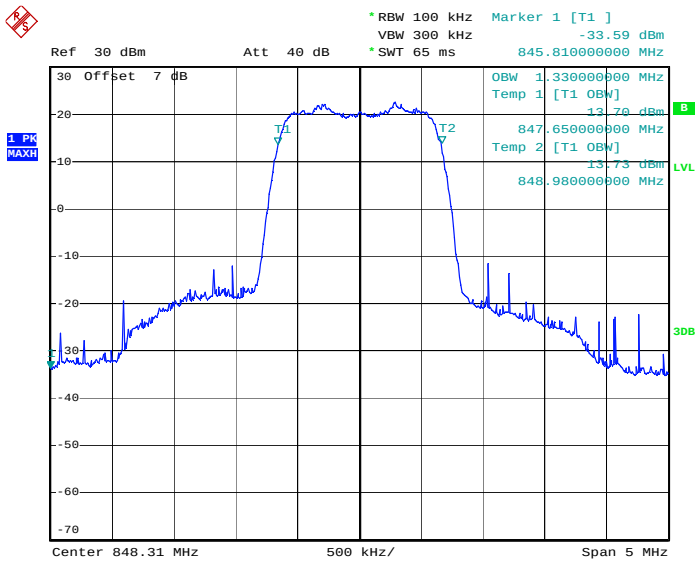

Date: 13.MAY.2015 14:26:03

**Cell Channel 384, 99% Bandwidth**



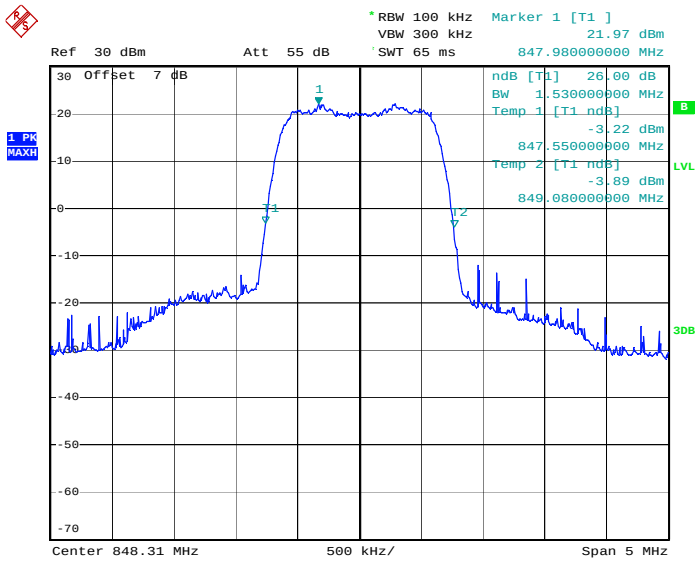

Date: 13.MAY.2015 14:25:26

**Cell Channel 384, 26dB Bandwidth**



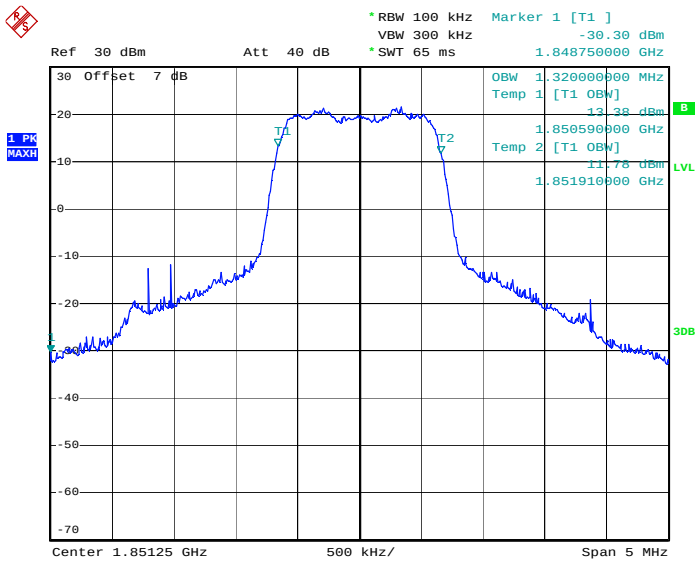

Date: 13.MAY.2015 14:27:11

**Cell Channel 777, 99% Bandwidth**



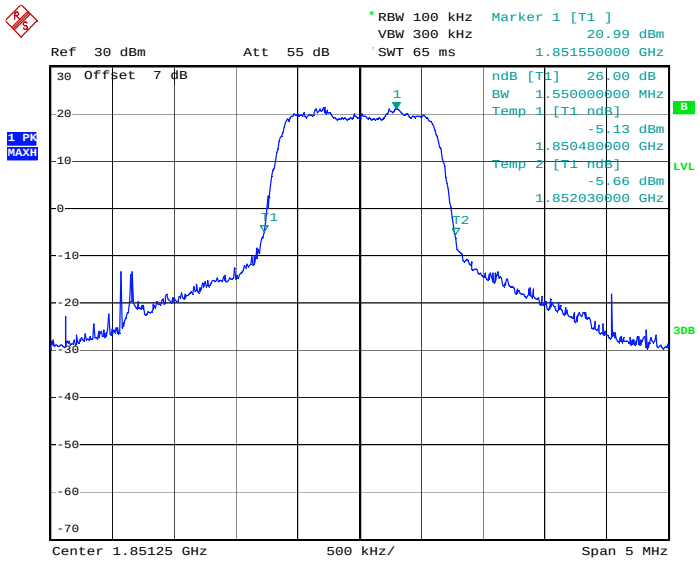

Date: 13.MAY.2015 14:28:18

**Cell Channel 777, 26dB Bandwidth**



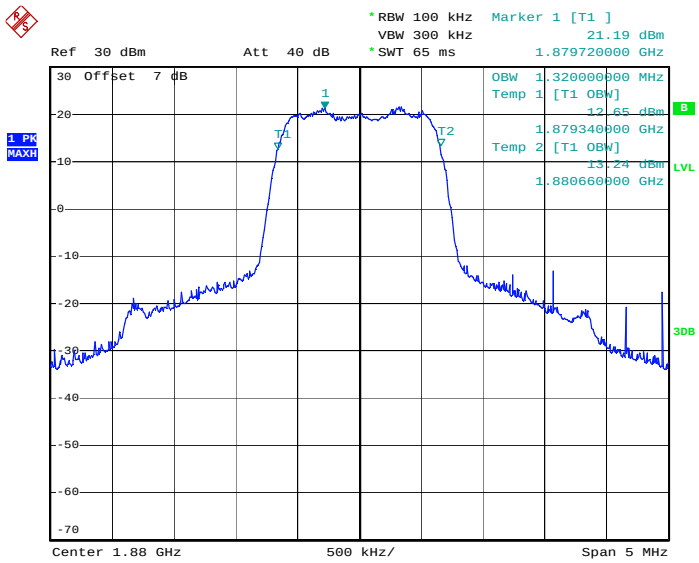

Date: 13.MAY.2015 14:29:47

**PCS Channel 25, 99% Bandwidth**



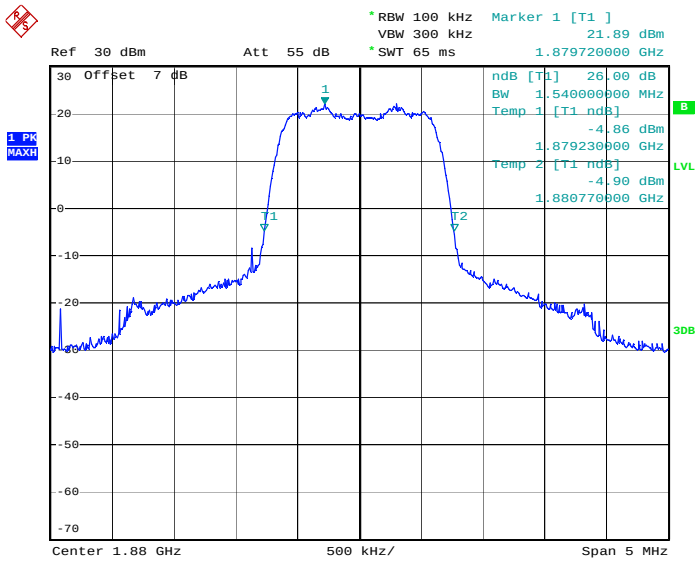

Date: 13.MAY.2015 14:30:36

**PCS Channel 25, 26dB Bandwidth**



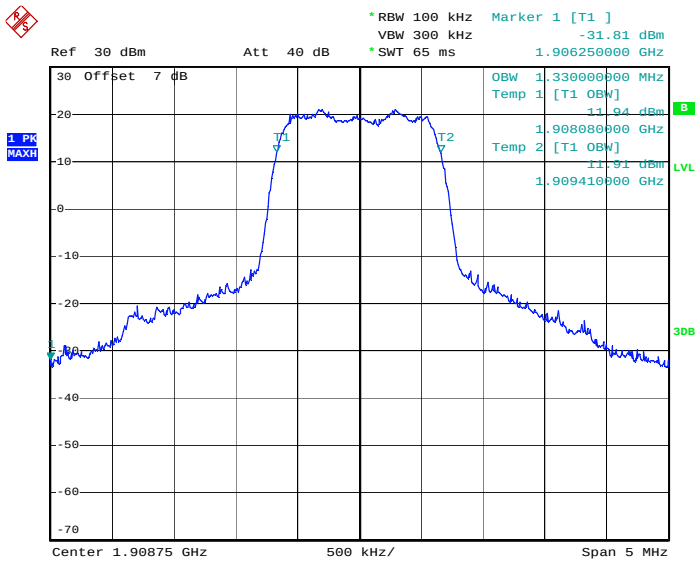

Date: 13.MAY.2015 14:31:50

**PCS Channel 600, 99% Bandwidth**



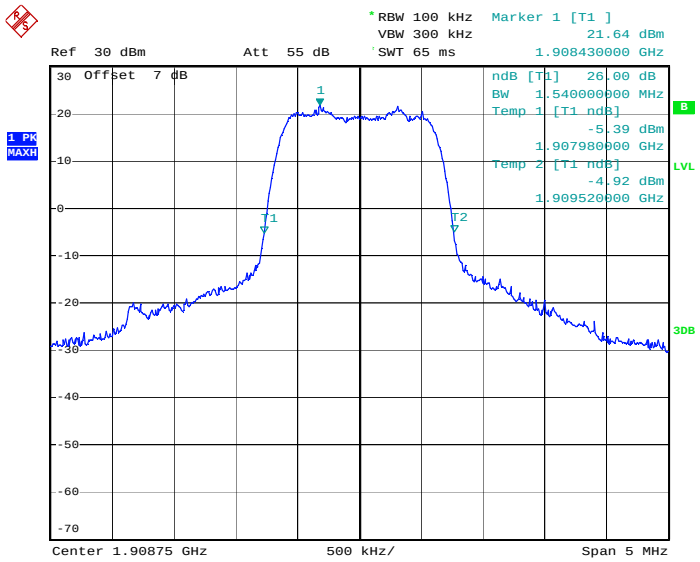

Date: 13.MAY.2015 14:31:19

**PCS Channel 600, 26dB Bandwidth**




Date: 13.MAY.2015 14:32:58

**PCS Channel 1175, 99% Bandwidth**




Date: 13.MAY.2015 14:33:43

**PCS Channel 1175, 26dB Bandwidth**

# 6 Conducted Spurious Emissions at Antenna Terminals

## 6.1 Test Limits

**§ 2.1049**

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

**§ 2.1051**

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

**§ 22.917**

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

**§ 24.238**

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 6.2 Test Procedure

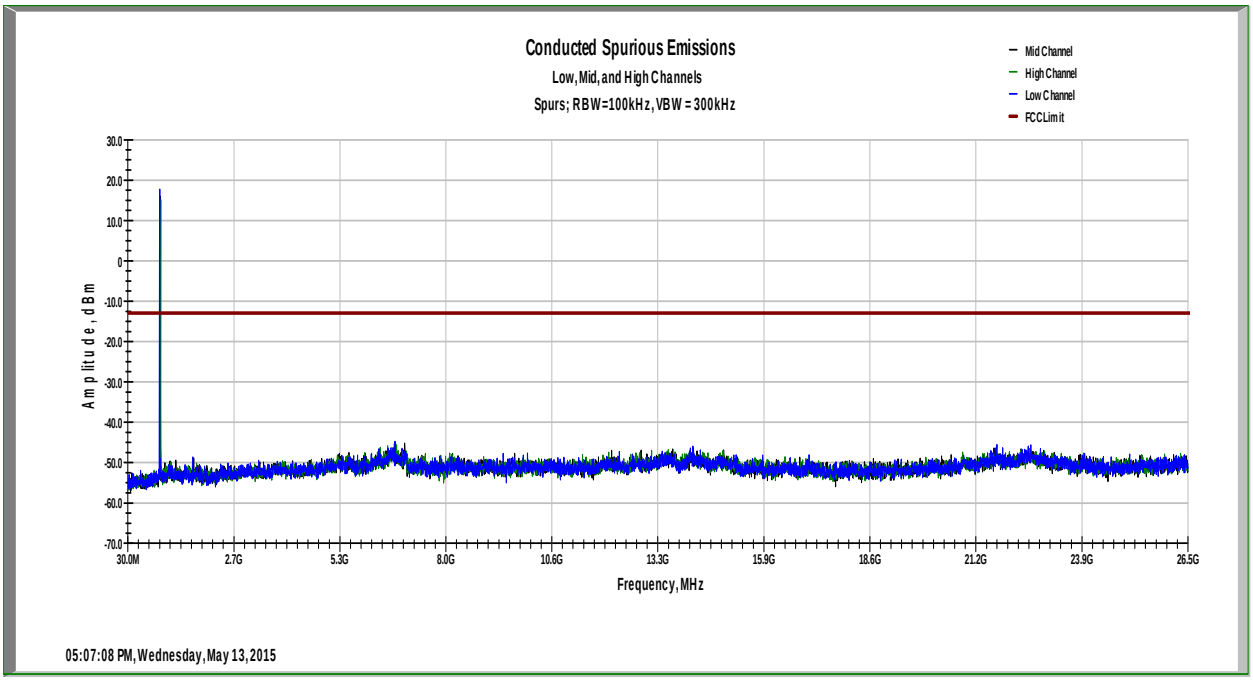
The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The base station simulator was set to force the EUT to its maximum power setting. The resolution bandwidth of the spectrum analyzer was set at 100kHz or 1MHz depending on the transmit band and the detector was set to peak detection for general scans up to the $10^{th}$ harmonic. Emissions scans near the fundamental were measured using an RMS detector. Sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

### 6.3 Test Equipment Used:

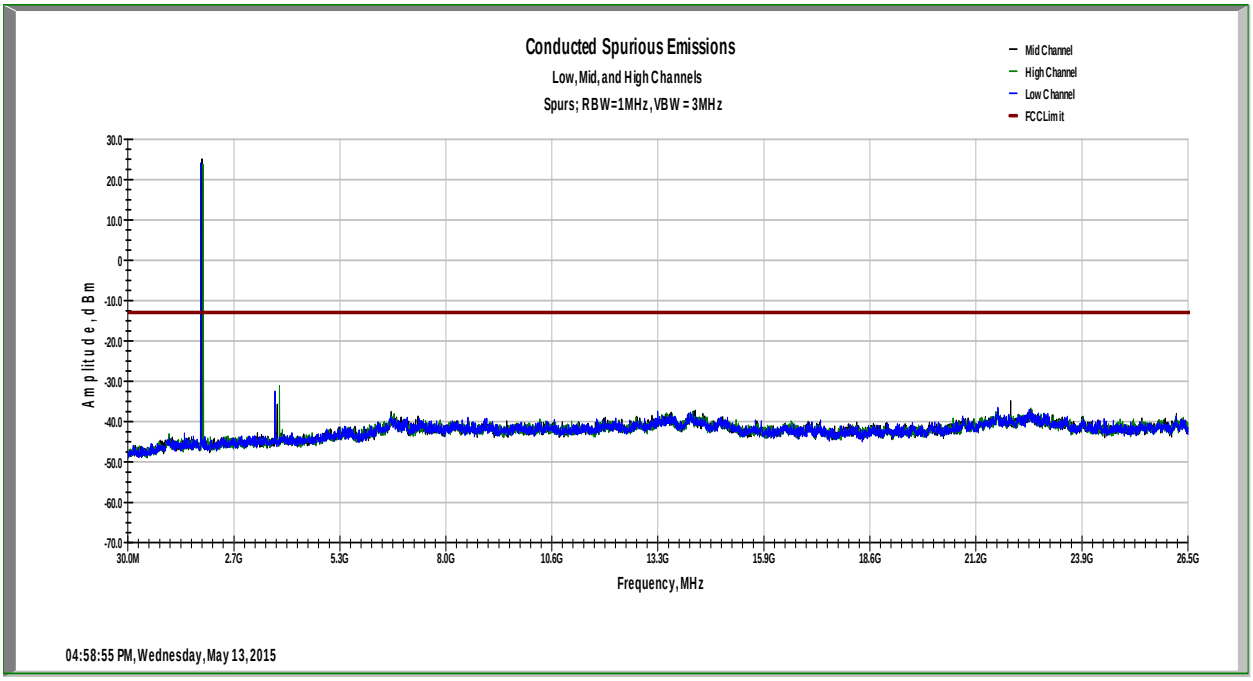
| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Base Station Simulator | 3956 | Rohde & Schwarz | CMU200 | 9/18/2014 | 9/18/2015 |
| Spectrum Analyzer | 3720 | Rohde & Schwarz | FSEK30 | 9/15/2014 | 9/15/2015 |
| Spectrum Analyzer | 3099 | Rohde & Schwarz | FSP7 | 9/15/2014 | 9/15/2015 |
| Power Divider | E18106 | Weinschell Engineering | 1506A | Time of Use | Time of Use |

### 6.4 Results:

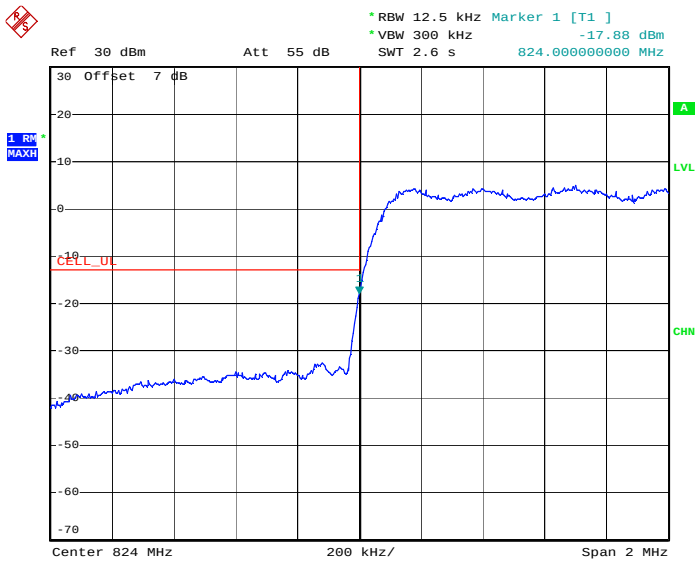
The following plots show that all spurious emissions are attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. Plots for emissions within 1MHz of the band edge as well as for emission outside of this range are shown.




**Cell Channel Conducted Spurious Emissions, Low, Mid, and High Channels**

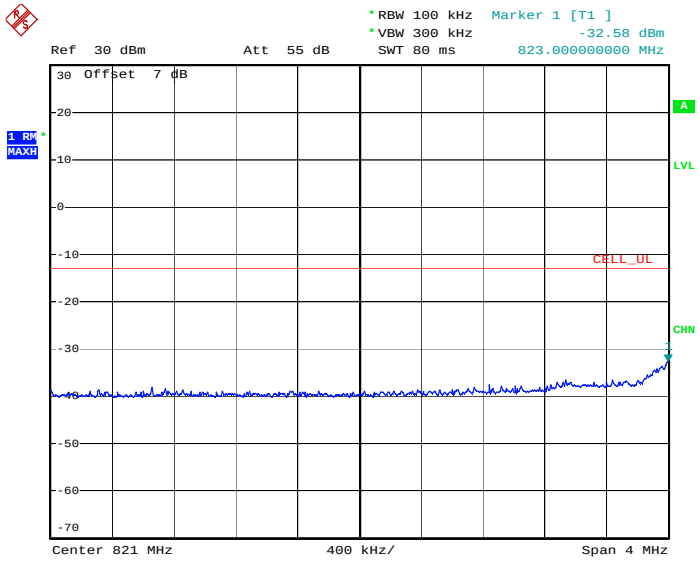



**PCS Band Conducted Spurious Emissions, Low, Mid, and High Channels**

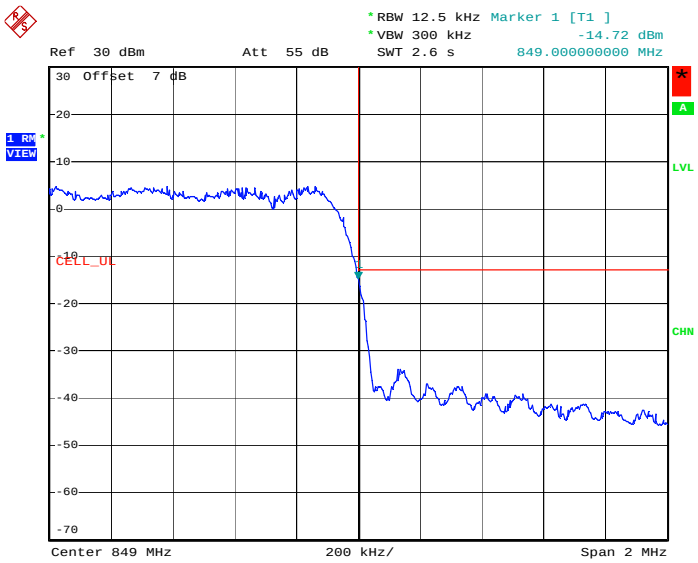



Bandwidth Correction Factor = 10log(15.4kHz / 12.5kHz) = 0.9dB
Corrected Band Edge Measurement = -17.88dBm + 0.9dB = -16.98dBm

**Cell Channel 1013, Low Band Edge**



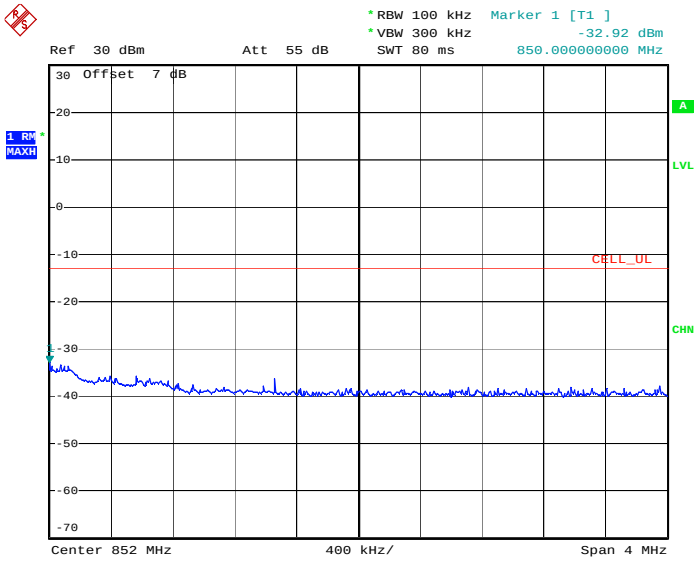

**Cell Channel 1013, Low Block Edge**




Date: 13.MAY.2015 16:14:22

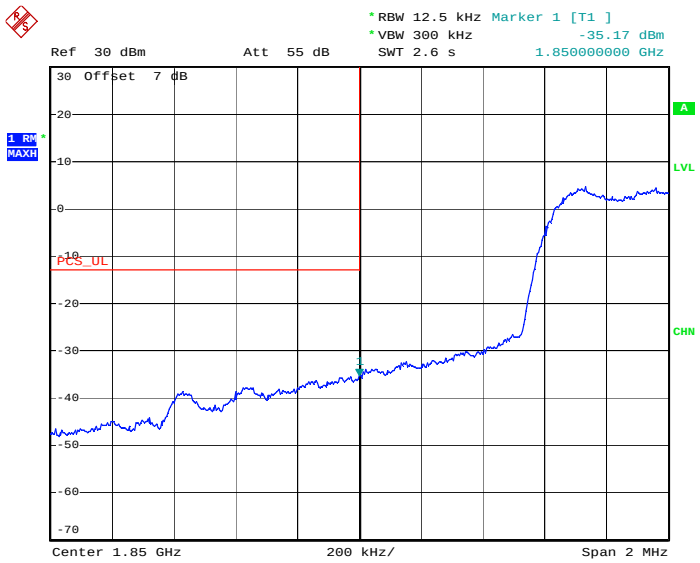
Bandwidth Correction Factor = 10log(15.3kHz / 12.5kHz) = 0.87dB
Corrected Band Edge Measurement = -14.72 + 0.87dB = -13.85dBm

**Cell Channel 777, High Band Edge**



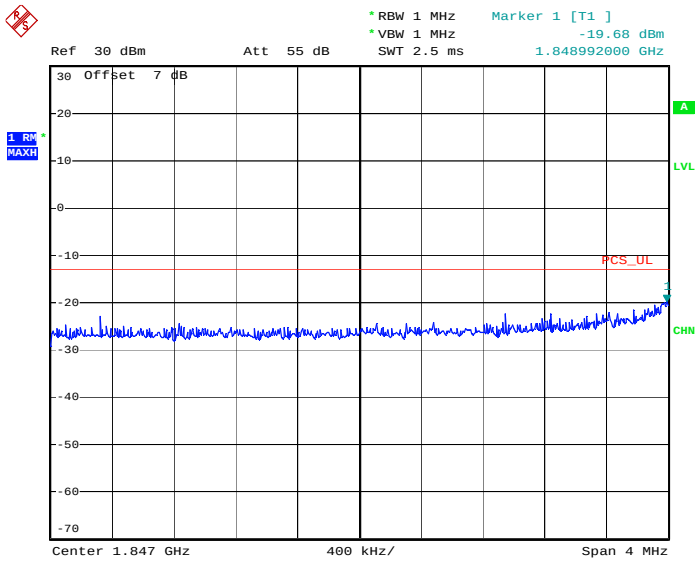

Date: 13.MAY.2015 16:06:06

**Cell Channel 777, High Block Edge**

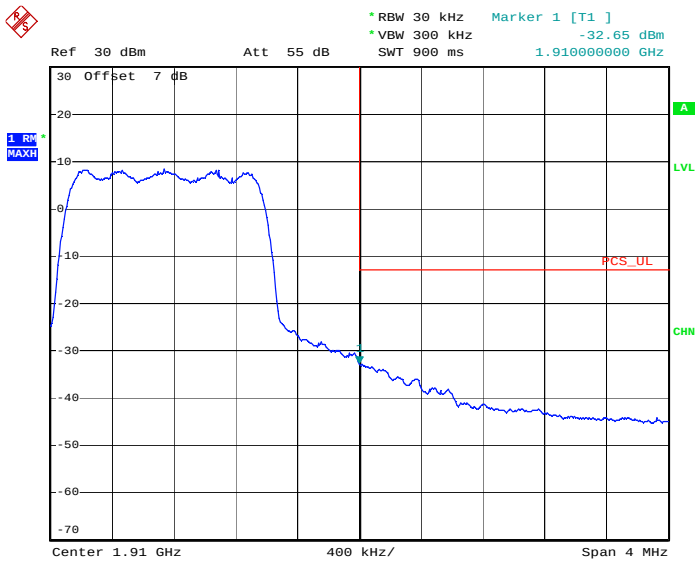



Bandwidth Correction Factor = 10log(15.6kHz / 12.5kHz) = 0.96dB
Corrected Band Edge Measurement = -35.17dBm + 0.96dB = -34.21dBm

**PCS Channel 25, Low Band Edge**

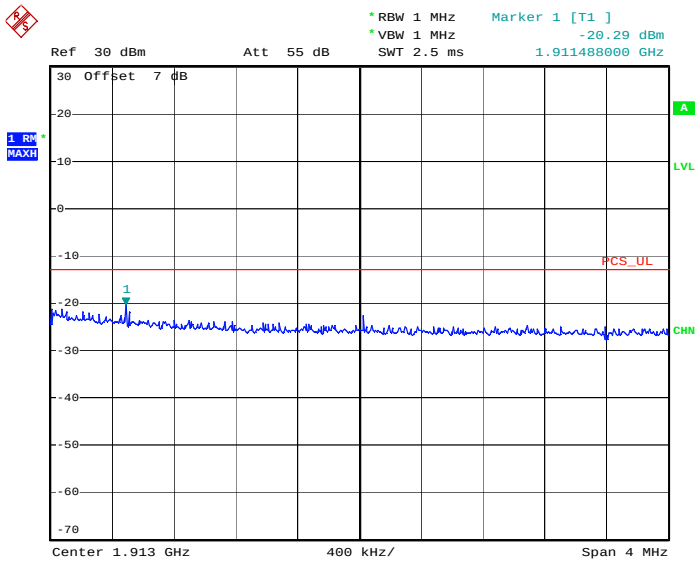



**PCS Channel 25, Low Block Edge**




Date: 13.MAY.2015 16:23:35

**PCS Channel 1175, High Band Edge**




Date: 13.MAY.2015 16:28:13

**PCS Channel 1175, High Block Edge**

# 7 Radiated Output Power

## 7.1 Test Limits

**§ 22.913**

(a) (2) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

**§ 24.232**

(c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

## 7.2 Test Procedure

The radiated output power was determined by adding the peak antenna gain to the measured conducted output power to determine the peak radiated power.

$$ERP = ConductedOutputPower(dBm) + AntennaGain(dBi) - 2.15$$

$$EIRP = ConductedOutputPower(dBm) + AntennaGain(dBi)$$

## 7.3 Results:

The PocketECG III, type PECGT-IIIV meets the radiated power requirements of FCC §22.913 and §24.232.

| Band | Channel | Frequency (MHz) | Cond Power (dBm) | Antenna Gain (dBi) | EIRP (dBi) | ERP (dBm) |
|---|---|---|---|---|---|---|
| | 1013 | 824.7 | 23.69 | 1.4 | 25.09 | 22.94 |
| | 384 | 836.52 | 24.01 | 1.4 | 25.41 | 23.26 |
| Cellular | 777 | 848.31 | 23.51 | 1.4 | 24.91 | 22.76 |
| | 25 | 1851.25 | 23.61 | 1.1 | 24.71 | 22.56 |
| | 600 | 1880 | 23.6 | 1.1 | 24.7 | 22.55 |
| PCS | 1175 | 1908.75 | 23.47 | 1.1 | 24.57 | 22.42 |

# 8 Radiated Spurious Emissions (Transmitter)

## 8.1 Test Limits

**§ 2.1053**

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

**§ 22.917**

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

**§ 24.238**

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

## 8.2 Test Procedure

The EUT was placed on a non-conductive turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. The EUT was forced to transmit at its maximum output power setting. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic was investigated in order to identify the spurious emission. Once the spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-C. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and at the spurious emissions frequency.

## 8.3 Test Equipment Used:

| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| EMI Test Receiver | 1302.6005.40 | Rohde&Schwarz | ESU40 | 9/17/2014 | 9/17/2015 |
| Preamplifier | 122005 | Rohde&Schwarz | TS-PR18 | 11/26/2014 | 11/26/2015 |
| Horn Antenna | 6556 | ETS | 3115 | 12/1/2014 | 12/1/2015 |
| Horn Antenna | 00154521 | ETS | 3117 | 10/21/2014 | 10/21/2015 |
| Bilog Antenna | 2362 | ETS | 3142B | 1/16/2015 | 1/16/2016 |
| Bilog Antenna | 00051864 | ETS | 3142C | 1/20/2015 | 1/20/2016 |
| System Controller | 121701-1 | Sunol Sciences | SC99V | Time of Use | Time of Use |
| High Pass Filter | 1 | Wainwright | WHKX12-2533.85-2710-18000-40SS | Time of Use | Time of Use |
| High Pass Filter | 25 | Wainwright | WHKX12-1028.5-1100-1500-40SS | Time of Use | Time of Use |
| Base Station Simulator | 2522 | Rohde&Schwarz | CMU200 | 9/19/2014 | 9/19/2015 |
| Signal Generator | 3915 | Rohde&Schwarz | SMB100A | 9/23/2014 | 9/23/2015 |

## 8.4 Results:

All radiated spurious emissions were attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB which is equivalent to -13dBm. The emissions were measured using an RMS detector and the analyzer was gated so that the emission was only measured during the on-times of the transmitter.

**Worst Case Spurious Measurements – Cell Band – Channel 1013**

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|---|---|
| 1650.105000 | -46.91 | -13.00 | 33.91 | 1000.000 | 132.3 | H | 343.0 |
| 2467.242000 | -56.76 | -13.00 | 43.76 | 1000.000 | 189.9 | V | 0.0 |
| 3304.840500 | -57.13 | -13.00 | 44.13 | 1000.000 | 163.7 | V | 127.0 |
| 4125.480000 | -47.71 | -13.00 | 34.71 | 1000.000 | 113.0 | V | 65.0 |
| 4946.944500 | -55.65 | -13.00 | 42.65 | 1000.000 | 200.0 | V | 272.0 |
| 5771.578500 | -53.03 | -13.00 | 40.03 | 1000.000 | 127.2 | V | 6.0 |
| 6595.893000 | -51.83 | -13.00 | 38.83 | 1000.000 | 200.0 | V | 316.0 |
| 7415.701500 | -51.53 | -13.00 | 38.53 | 1000.000 | 113.5 | V | 268.0 |
| 8250.108000 | -50.01 | -13.00 | 37.01 | 1000.000 | 101.5 | H | 318.0 |
| 9072.889500 | -50.68 | -13.00 | 37.68 | 1000.000 | 102.8 | H | 104.0 |

**Worst Case Spurious Measurements – Cell Band – Channel 384**

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|---|---|
| 1672.241000 | -52.90 | -13.00 | 39.90 | 1000.000 | 226.5 | H | 324.0 |
| 1672.377000 | -53.58 | -13.00 | 40.58 | 1000.000 | 101.0 | H | 307.0 |
| 2509.495500 | -55.71 | -13.00 | 42.71 | 1000.000 | 214.7 | H | 0.0 |
| 3346.080000 | -53.66 | -13.00 | 40.66 | 1000.000 | 100.0 | V | 0.0 |
| 4182.600000 | -50.13 | -13.00 | 37.13 | 1000.000 | 100.0 | V | 0.0 |
| 4184.000000 | -51.85 | -13.00 | 38.85 | 1000.000 | 100.0 | V | 0.0 |
| 5019.120000 | -54.84 | -13.00 | 41.84 | 1000.000 | 100.0 | H | 0.0 |
| 5855.640000 | -52.37 | -13.00 | 39.37 | 1000.000 | 100.0 | H | 0.0 |
| 6692.160000 | -51.93 | -13.00 | 38.93 | 1000.000 | 100.0 | H | 0.0 |
| 7528.680000 | -50.86 | -13.00 | 37.86 | 1000.000 | 100.0 | V | 0.0 |
| 8365.200000 | -52.46 | -13.00 | 39.46 | 1000.000 | 100.0 | H | 0.0 |
| 9201.720000 | -51.38 | -13.00 | 38.38 | 1000.000 | 100.0 | V | 0.0 |

**Worst Case Spurious Measurements – Cell Band – Channel 777**

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|---|---|
| 1696.072500 | -49.21 | -13.00 | 36.21 | 1000.000 | 113.0 | V | 222.0 |
| 2541.646500 | -56.27 | -13.00 | 43.27 | 1000.000 | 200.0 | H | 127.0 |
| 3392.539500 | -55.21 | -13.00 | 42.21 | 1000.000 | 152.1 | V | 147.0 |
| 4239.832500 | -45.98 | -13.00 | 32.98 | 1000.000 | 98.0 | V | 62.0 |
| 5096.265000 | -54.65 | -13.00 | 41.65 | 1000.000 | 98.1 | H | 228.0 |
| 5944.593000 | -53.02 | -13.00 | 40.02 | 1000.000 | 128.1 | V | 329.0 |
| 6782.995500 | -53.14 | -13.00 | 40.14 | 1000.000 | 150.9 | V | 102.0 |
| 7641.448500 | -52.31 | -13.00 | 39.31 | 1000.000 | 175.9 | V | 56.0 |
| 8477.206500 | -51.69 | -13.00 | 38.69 | 1000.000 | 200.0 | H | 0.0 |
| 9334.828500 | -51.56 | -13.00 | 38.56 | 1000.000 | 200.1 | V | 162.0 |

**Worst Case Spurious Measurements – PCS Band – Channel 1175**

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|---|---|
| 3817.558500 | -40.23 | -13.00 | 27.23 | 1000.000 | 97.9 | V | 125.0 |
| 5720.854500 | -52.97 | -13.00 | 39.97 | 1000.000 | 98.0 | H | 318.0 |
| 7633.261500 | -50.86 | -13.00 | 37.86 | 1000.000 | 200.1 | V | 94.0 |
| 9538.827000 | -50.33 | -13.00 | 37.33 | 1000.000 | 127.2 | H | 272.0 |
| 11457.711000 | -50.07 | -13.00 | 37.07 | 1000.000 | 115.1 | H | 280.0 |
| 13362.235500 | -46.76 | -13.00 | 33.76 | 1000.000 | 200.0 | H | 54.0 |
| 15268.636500 | -45.05 | -13.00 | 32.05 | 1000.000 | 125.9 | H | 76.0 |
| 17176.548000 | -44.15 | -13.00 | 31.15 | 1000.000 | 113.1 | H | 217.0 |

**Worst Case Spurious Measurements – PCS Band – Channel 25**

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|---|---|
| 5549.019000 | -51.09 | -13.00 | 38.09 | 1000.000 | 152.4 | H | 292.0 |
| 7399.543000 | -52.29 | -13.00 | 39.29 | 1000.000 | 138.4 | H | 268.0 |
| 9250.998500 | -51.14 | -13.00 | 38.14 | 1000.000 | 200.1 | H | 160.0 |
| 11114.383500 | -49.38 | -13.00 | 36.38 | 1000.000 | 156.0 | H | 184.0 |
| 12953.134000 | -46.99 | -13.00 | 33.99 | 1000.000 | 150.9 | V | 9.0 |
| 14814.825500 | -46.10 | -13.00 | 33.10 | 1000.000 | 138.0 | H | 114.0 |
| 16662.252000 | -42.94 | -13.00 | 29.94 | 1000.000 | 101.3 | V | 9.0 |
| 3703.200000 | -39.35 | -13.00 | 26.35 | 1000.000 | 108.7 | V | 26.0 |

**Worst Case Spurious Measurements – PCS Band – Channel 600**

| Frequency (MHz) | MaxPeak (dBm) | Limit (dBm) | Margin (dB) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) |
|---|---|---|---|---|---|---|---|
| 1878.137000 | -59.02 | -13.00 | 46.02 | 1000.000 | 139.9 | H | 7.0 |
| 3759.859000 | -41.91 | -13.00 | 28.91 | 1000.000 | 103.5 | V | 124.0 |
| 5642.491500 | -52.02 | -13.00 | 39.02 | 1000.000 | 200.0 | H | 243.0 |
| 7520.606000 | -51.41 | -13.00 | 38.41 | 1000.000 | 200.1 | V | 6.0 |
| 9399.052000 | -50.50 | -13.00 | 37.50 | 1000.000 | 151.6 | V | 166.0 |
| 11276.763000 | -49.35 | -13.00 | 36.35 | 1000.000 | 126.2 | V | 180.0 |
| 13166.486000 | -46.68 | -13.00 | 33.68 | 1000.000 | 154.7 | V | 36.0 |
| 15041.533000 | -46.29 | -13.00 | 33.29 | 1000.000 | 97.9 | V | 80.0 |
| 16924.992000 | -43.55 | -13.00 | 30.55 | 1000.000 | 199.9 | V | 192.0 |

# 9 Frequency Stability

## 9.1 Test Limits

**§ 2.1055, §22.355, §24.235**

The frequency stability of the transmitter was required to maintain a ±2.5ppm tolerance.

## 9.2 Test Procedure

The equipment under test was connected to an AC variac and the RF output was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for that purpose. After the temperature stabilized for approximately 30 minutes, the frequency error was read from the base station simulator. At 20C the input voltage was varied from 85% to 115% and the frequency stability vs input voltage was recorded.

## 9.3 Test Equipment Used:

| Description | Serial Number | Manufacturer | Model | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Base Station Simulator | 3956 | Rohde & Schwarz | CMU200 | 9/18/2014 | 9/18/2015 |
| Environmental Chamber | 32692 | Thermotron | SM-8C | 2/24/2015 | 2/24/2016 |
| Multimeter/Temp Meter | 3400 | Fluke | 289 | 5/29/2014 | 5/29/2015 |

## 9.4 Results:

The tables below show the frequency stability data for both Cell and PCS Bands. In both cases the test sample met the ±2.5ppm limit.

**Frequency Stability for CDMA Cell Band**

| | | | | | |
|---|---|---|---|---|---|
| **Operating Freqeuncy:** | | 824,700,000 | Hz | | |
| **Channel:** | | 1013 | | | |
| **Reference Voltage:** | | 3.7 | VDC | | |
| **Deviation Limit:** | | 2.5 | ppm | | |
| **Notes:** | Frequency Stability in CDMA Cell Band | | | | |

| Voltage (%) | Voltage (VDC) | Temp (℃) | Frequency Error (Hz) | Deviation (%) | Deviation (ppm) |
|---|---|---|---|---|---|
| 100% | 3.7 | -30 | 8 | 0.0000010 | 0.0097 |
| 100% | 3.7 | -20 | 4 | 0.0000005 | 0.0049 |
| 100% | 3.7 | -10 | 6 | 0.0000007 | 0.0073 |
| 100% | 3.7 | 0 | 5 | 0.0000006 | 0.0061 |
| 100% | 3.7 | 10 | 7 | 0.0000008 | 0.0085 |
| 100% | 3.7 | 20 | 3 | 0.0000004 | 0.0036 |
| 100% | 3.7 | 30 | -7 | -0.0000008 | -0.0085 |
| 100% | 3.7 | 40 | -4 | -0.0000005 | -0.0049 |
| 100% | 3.7 | 50 | 2 | 0.0000002 | 0.0024 |
| 100% | 3.7 | 60 | 7 | 0.0000008 | 0.0085 |
| 115% | 3.145 | 20 | -3 | -0.0000004 | -0.0036 |
| 85% | 4.255 | 20 | -6 | -0.0000007 | -0.0073 |

**Frequency Stability for CDMA Cell Band**

| | | | | | |
|---|---|---|---|---|---|
| **Operating Freqeuncy:** | | 836,520,000 | Hz | | |
| **Channel:** | | 384 | | | |
| **Reference Voltage:** | | 3.7 | VDC | | |
| **Deviation Limit:** | | 2.5 | ppm | | |
| **Notes:** | Frequency Stability in CDMA Cell Band | | | | |

| Voltage (%) | Voltage (VDC) | Temp (℃) | Frequency Error (Hz) | Deviation (%) | Deviation (ppm) |
|---|---|---|---|---|---|
| 100% | 3.7 | -30 | 9 | 0.0000011 | 0.0108 |
| 100% | 3.7 | -20 | 4 | 0.0000005 | 0.0048 |
| 100% | 3.7 | -10 | 9 | 0.0000011 | 0.0108 |
| 100% | 3.7 | 0 | -2 | -0.0000002 | -0.0024 |
| 100% | 3.7 | 10 | -6 | -0.0000007 | -0.0072 |
| 100% | 3.7 | 20 | -7 | -0.0000008 | -0.0084 |
| 100% | 3.7 | 30 | 6 | 0.0000007 | 0.0072 |
| 100% | 3.7 | 40 | 6 | 0.0000007 | 0.0072 |
| 100% | 3.7 | 50 | 7 | 0.0000008 | 0.0084 |
| 100% | 3.7 | 60 | -6 | -0.0000007 | -0.0072 |
| 115% | 3.145 | 20 | -6 | -0.0000007 | -0.0072 |
| 85% | 4.255 | 20 | 7 | 0.0000008 | 0.0084 |

**Frequency Stability for CDMA Cell Band**

| | | | | | |
|---|---|---|---|---|---|
| **Operating Freqeuncy:** | | 848,310,000 | Hz | | |
| **Channel:** | | 777 | | | |
| **Reference Voltage:** | | 3.7 | VDC | | |
| **Deviation Limit:** | | 2.5 | ppm | | |
| **Notes:** | Frequency Stability in CDMA Cell Band | | | | |

| Voltage (%) | Voltage (VDC) | Temp (℃) | Frequency Error (Hz) | Deviation (%) | Deviation (ppm) |
|---|---|---|---|---|---|
| 100% | 3.7 | -30 | 13 | 0.0000016 | 0.0158 |
| 100% | 3.7 | -20 | 8 | 0.0000010 | 0.0097 |
| 100% | 3.7 | -10 | 10 | 0.0000012 | 0.0121 |
| 100% | 3.7 | 0 | -7 | -0.0000008 | -0.0085 |
| 100% | 3.7 | 10 | 10 | 0.0000012 | 0.0121 |
| 100% | 3.7 | 20 | 8 | 0.0000010 | 0.0097 |
| 100% | 3.7 | 30 | 6 | 0.0000007 | 0.0073 |
| 100% | 3.7 | 40 | -5 | -0.0000006 | -0.0061 |
| 100% | 3.7 | 50 | 6 | 0.0000007 | 0.0073 |
| 100% | 3.7 | 60 | -8 | -0.0000010 | -0.0097 |
| 115% | 3.145 | 20 | -7 | -0.0000008 | -0.0085 |
| 85% | 4.255 | 20 | 6 | 0.0000007 | 0.0073 |

**Frequency Stability for CDMA PCS Band**

| | | | | | |
|---|---|---|---|---|---|
| **Operating Freqeuncy:** | | 1,851,250,000 | Hz | | |
| **Channel:** | | 25 | | | |
| **Reference Voltage:** | | 3.7 | VDC | | |
| **Deviation Limit:** | | 2.5 | ppm | | |
| **Notes:** | Frequency Stability in CDMA PCS Band | | | | |

| Voltage (%) | Voltage (VDC) | Temp (℃) | Frequency Error (Hz) | Deviation (%) | Deviation (ppm) |
|---|---|---|---|---|---|
| 100% | 3.7 | -30 | 23 | 0.0000027 | 0.0275 |
| 100% | 3.7 | -20 | 17 | 0.0000020 | 0.0203 |
| 100% | 3.7 | -10 | 12 | 0.0000014 | 0.0143 |
| 100% | 3.7 | 0 | -32 | -0.0000038 | -0.0383 |
| 100% | 3.7 | 10 | -32 | -0.0000038 | -0.0383 |
| 100% | 3.7 | 20 | -15 | -0.0000018 | -0.0179 |
| 100% | 3.7 | 30 | 18 | 0.0000022 | 0.0215 |
| 100% | 3.7 | 40 | -19 | -0.0000023 | -0.0227 |
| 100% | 3.7 | 50 | -24 | -0.0000029 | -0.0287 |
| 100% | 3.7 | 60 | 19 | 0.0000023 | 0.0227 |
| 115% | 3.145 | 20 | -16 | -0.0000019 | -0.0191 |
| 85% | 4.255 | 20 | 8 | 0.0000010 | 0.0096 |

**Frequency Stability for CDMA PCS Band**

| | | | | | |
|---|---|---|---|---|---|
| **Operating Freqeuncy:** | | 1,800,000,000 | Hz | | |
| **Channel:** | | 600 | | | |
| **Reference Voltage:** | | 3.7 | VDC | | |
| **Deviation Limit:** | | 2.5 | ppm | | |
| **Notes:** | Frequency Stability in CDMA PCS Band | | | | |

| Voltage (%) | Voltage (VDC) | Temp (°C) | Frequency Error (Hz) | Deviation (%) | Deviation (ppm) |
|---|---|---|---|---|---|
| 100% | 3.7 | -30 | 12 | 0.0000015 | 0.0146 |
| 100% | 3.7 | -20 | 16 | 0.0000019 | 0.0194 |
| 100% | 3.7 | -10 | -14 | -0.0000017 | -0.0170 |
| 100% | 3.7 | 0 | -15 | -0.0000018 | -0.0182 |
| 100% | 3.7 | 10 | 17 | 0.0000021 | 0.0206 |
| 100% | 3.7 | 20 | -16 | -0.0000019 | -0.0194 |
| 100% | 3.7 | 30 | 7 | 0.0000008 | 0.0085 |
| 100% | 3.7 | 40 | -13 | -0.0000016 | -0.0158 |
| 100% | 3.7 | 50 | -15 | -0.0000018 | -0.0182 |
| 100% | 3.7 | 60 | 16 | 0.0000019 | 0.0194 |
| 115% | 3.145 | 20 | -12 | -0.0000015 | -0.0146 |
| 85% | 4.255 | 20 | 9 | 0.0000011 | 0.0109 |

**Frequency Stability for CDMA PCS Band**

| | | | | | |
|---|---|---|---|---|---|
| **Operating Freqeuncy:** | | 1,908,750,000 | Hz | | |
| **Channel:** | | 1175 | | | |
| **Reference Voltage:** | | 3.7 | VDC | | |
| **Deviation Limit:** | | 2.5 | ppm | | |
| **Notes:** | Frequency Stability in CDMA PCS Band | | | | |

| Voltage (%) | Voltage (VDC) | Temp (°C) | Frequency Error (Hz) | Deviation (%) | Deviation (ppm) |
|---|---|---|---|---|---|
| 100% | 3.7 | -30 | -32 | -0.0000038 | -0.0383 |
| 100% | 3.7 | -20 | -30 | -0.0000036 | -0.0359 |
| 100% | 3.7 | -10 | -35 | -0.0000042 | -0.0418 |
| 100% | 3.7 | 0 | -18 | -0.0000022 | -0.0215 |
| 100% | 3.7 | 10 | 12 | 0.0000014 | 0.0143 |
| 100% | 3.7 | 20 | 17 | 0.0000020 | 0.0203 |
| 100% | 3.7 | 30 | -21 | -0.0000025 | -0.0251 |
| 100% | 3.7 | 40 | -18 | -0.0000022 | -0.0215 |
| 100% | 3.7 | 50 | 14 | 0.0000017 | 0.0167 |
| 100% | 3.7 | 60 | -12 | -0.0000014 | -0.0143 |
| 115% | 3.145 | 20 | -10 | -0.0000012 | -0.0120 |
| 85% | 4.255 | 20 | 8 | 0.0000010 | 0.0096 |

## 10 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of k = 2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

| Parameter | Uncertainty | Notes |
|---|---|---|
| Radiated emissions, 30 to 1000 MHz | ±3.9dB | |
| Radiated emissions, 1 to 18 GHz | ±4.2dB | |
| Radiated emissions, 18 to 40 GHz | ±4.3dB | |
| Power Port Conducted emissions, 150kHz to 30 MHz | +2.8dB | |

## 11 Revision History

| Revision Level | Date | Report Number | Notes |
|---|---|---|---|
| 0 | 5/29/2015 | 102083831LEX-002 | Original Issue |
| | | | |
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